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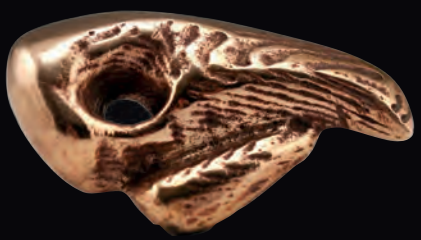

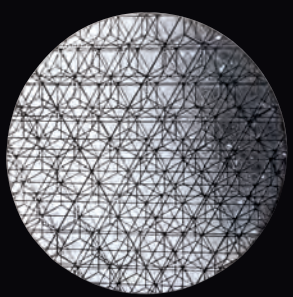

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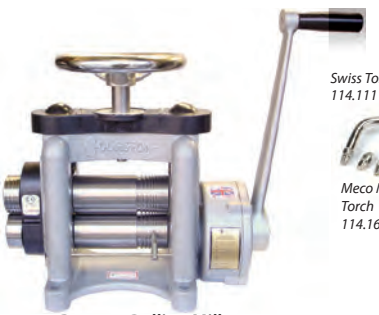

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• Top: A student cast using cuttlebone (see pg. 24)
• Bottom: **Bryan Parnham,** *New Structure Brooch,* 2017 (see p.32)

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Welcome to the first issue of *Metalsmith Tech,* a new biannual publication from SNAG that aims to be a resource for everyone interested in making a life in jewelry and metals. The editorial content will take on the notion of "how-to" in a functional sense, investigating tools and techniques in the field. But the lively conversation in these pages will also explore the how-tos of building your life as an artist, whether that's finding opportunities for personal inspiration and reflection, providing information on grants and fellowships, developing a sustainable career, or growing your teaching practice.

Metalsmith Tech No. 1 speaks to this breadth. In our first *Studio Views*, a feature that discusses best practices for studio set-up, Dianne deBeixedon offers a warm, personal, and practical take on how to build a functional working space from scratch—on any budget. In *Tech Toolkit*, Gabriel Craig's intimate narrative about the one tool he couldn't work without details how it has impacted his artistic and professional life. Tanya Crane and Jim Bové's pieces both reflect on teaching, but in different ways. Crane discusses the benefits of being an educator in an interdisciplinary university program, while Bové offers a detailed step-by-step process for cuttlefish bone casting with younger students. *Tech Talk* finds Ben Dory taking a deep dive into electrolytic etching, with illustrations and examples of contemporary artists using the technique to manifest their artistic vision. Columns like *Opportunity Knocks* and *Cross Currents* dive into resources both at the center and on the perimeter of the metals and jewelry field. Each author offers sage and compelling food for thought, whether you're contemplating creating a business plan or tired of relying on the "exposure economy."

Future issues of *Metalsmith Tech* will take on these kinds of topics and more. Whether you're a full-time artist or metalsmith, educator, student, or avid enthusiast, I hope you enjoy and find something valuable in this first outing. I look forward to hearing more about what you'd like to see covered and to learning alongside you. ***—Emily Zilber, Editor***

The mission of *Metalsmith Tech* is to focus on techniques, processes, educational philosophies and ideas, professional development topics, and new technology in the field of jewelry and metalsmithing. The magazine will include both contemporary and historical references, highlighting a diverse range of approaches to jewelry design and metalwork, including professional practices, creative influences, and new trends.

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VIVIAN BEER

SNAG's Keynote Speaker, Vivian Beer, is a furniture designer/maker based in New England. Her sleek, abstracted metal and concrete furniture combines the aesthetic sensibilities of contemporary design, craft, and sculpture to create objects that alter viewers' expectations of and interface with the domestic landscape. With a strong foundation in contemporary furniture design, her research into the history of American industry, architecture, and transportation adds intellectual rigor and specificity to her work.

Vivian holds an MFA from Cranbrook Academy and received their 2016 Alumni Achievement Award. Beer has won numerous awards and residencies including the Ellen DeGeneres Design Challenge, John D. Mineck Furniture Fellowship, Penland School of Crafts Residency, multiple Windgate Artist Residencies, Museum of Glass, Pilchuck, a Research Fellowship at the Smithsonian National Air and Space Museum, and was recently named a 2016 United States Artist Fellow.

For a full line-up of speakers and conference events, please visit the conference webpage: snagmetalsmith.org/conferences/made/

PRE-CONFERENCE WORKSHOPS:

SNAG is excited to offer pre-conference workshops this year at the Marriott Hotel Wednesday, May 23. Each workshop is geared toward helping you develop your professional practices. Off-site workshops are also being offered through the Oregon College of Art and Craft and the Form 3-D Foundry. Even if you've already registered for the conference, you can add-on these workshops now.

For a complete line-up, please visit snagmetalsmith.org

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Kristen Baird, *Boulder Necklace*, 2017. Baird was selected as the 2017 Halstead Grant winner.

OPPORTUNITY KNOCKS

Win Win: The Halstead Grant

The Halstead Grant can help you take your jewelry business—and design—to the next level.

BY KATIE HACKER

The Halstead Grant is the only award in the jewelry industry that rewards design excellence *and* business acumen among emerging designers. Now in its thirteenth year, the annual prize, sponsored by the family-run jewelry supplier Halstead Bead, Inc., based in Prescott, Arizona, offers invaluable feedback on an artist's work and the future potential of their business—as well as $7,500 cash and $1,000 in supplies. The top ten finalists receive prizes and feedback from a judging committee, which in 2018 includes artist Michael David Sturlin. Halstead President Hilary Halstead Scott says, "The health of the jewelry industry depends on the continuous flow of new talent and design creativity. It is critical that new artists also hone their business skills in order to effectively manage their small businesses in today's global market."

In addition to submitting photographs of their work, applicants must answer a variety of questions that form the basis of a business plan, culled from Halstead's forty-four years in the jewelry business and what the company has identified as important markers of an artist's success. Most emerging jewelers have never written this kind of document, nor have they had access to in-depth business training as a part of their undergraduate or graduate education. The application breaks it down into bite-size pieces, providing a useful model for any artist looking to understand the ins and outs of a business plan. Emily Shaffer, a finalist in 2017, extols, "Filling out my grant application was one of the most challenging yet fulfilling tasks I've had in the early stages of my business."

"I spent about one month of almost full-time work on the application, including research, photoshoots, updating my website, answering the questions, and formatting the physical application," says 2017 finalist Madeline Michael. "I would suggest starting early and spreading the work out over a longer period of time." Michael advises her peers "to at least download the application and review the questions. Even if they don't end up submitting the application, they will know where to focus their attention and what information is important to consider." The 2017 winner, Kristen Baird, notes that the application "taught me about branding in a way I had never thought about it before. Every detail, from the language I used to answer the questions, to the layout of my images,

to the collateral I presented had to be 'on brand.' For me, it was a challenge to determine my 'brand voice,' and it took a lot of time, but it has helped me tremendously as I continue to grow and expand my business."

A panel of judges reviews each application, scoring based on presentation, business plan, jewelry design, and overall potential. After several group conversations, in which the judges discuss the applications, the resulting comments are compiled for feedback reports. Most winners and finalists say the report is one of the most meaningful parts of the prize package. Baird regularly refers back to what the judging committee, which included jewelry gallerist, writer, and editor Marthe Le Van, recommended for her business. She emphasizes, "The points they made after reading my entire application—and I hear they are just as thorough in reading and discussing as the applicants are in preparing and presenting—are relevant, and happen to be things I needed to hear and act upon. It is one thing to get advice from friends, and trust me, everyone has something to say whether asked or not, but it is another thing to get specific feedback from a group of industry experts. That report is gold!" Alexandra Lozier, a finalist in 2017, says, "In addition to creating a solid business plan for the next few years, the feedback report gave me insight on new ideas to pursue, as well as validation of what already works."

For the Halstead family and the prize jury, one of the most exciting parts of the grant cycle is getting to know the winner and finalists, and championing their work. As 2016 guest judge Cathleen McCarthy, jewelry and arts writer and editor of the website *The Jewelry Loupe,* says, "The Halstead Grant is not just about funding a successful jewelry business. It's also about promoting the career of a designer." After the winner is determined, he or she is invited to the Halstead headquarters, which features an on-site teaching studio and lecture space, and is provided the opportunity to film a promotional video—a first for many jewelers. The winner and finalists are included in the Halstead catalog and in the annual Halstead Grant publication, *Reveal.*

For those considering submitting an application, Shaffer exhorts, "Do it. Even if you don't place in the top ten or submit the application on time. The process allows you to reflect on your present business and what you must to do make it a successful brand in the future. It's like a business plan template!"

Katie Hacker is the content strategist for Halstead Bead, Inc.

To download an application, learn more about the grant, and get a list of helpful tips for a successful application, visit grant.halsteadbead.com. The 2018 deadline is August 1.

Works by finalists for the 2017 Halstead Grant:

1
Kelsey Grape

2
Emily Shaffer Studio

3
Stacy Rodgers

4
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6
Alexandra Scarlett

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CROSS CURRENTS

W.A.G.E. Hike

Working Artists in the Greater Economy (W.A.G.E.) helps artists advocate for fair payment, not just "exposure."

BY LUKE T. BAKER

"We can't pay you, but it will be great exposure." It's a refrain undoubtedly familiar to artists who've been asked to participate in an exhibition, give a talk, or write a catalogue essay for certain nonprofit organizations, or even some commercial galleries. Those who actually *do* receive compensation for their labor and time often find that fees can vary widely, making it difficult to determine what constitutes fair payment. Providing free (or nominally compensated) work has become normalized as a "labor of love" that seems necessary for the advancement of one's artistic career—even when American jewelers and precious stone and metal workers are barely eking out a living.

With businesses to run, families to feed, and MFA degrees to pay off, what can jewelers and metalsmiths do to unseat this expectation to work for free? The problem of exploitative labor practices is certainly not unique to this industry, but one artist-run organization offers a compelling art-world model for taking offenders to task. W.A.G.E. (Working Artists in the Greater Economy) was founded in New York in 2008 by a group of visual and performing artists and curators to address the economically unjust relationship between arts institutions and the artists whose labor they contract; in 2011, it became certified as a 501c3 non-profit organization. Its primary *cri de coeur* is the remuneration of artist fees—and not just "exposure"—in exchange for participation in exhibitions and creating other types of commissioned content. The "exposure economy," W.A.G.E. argues, forces artists to become speculators, producing work for free (often at their own significant expense), while gallerists, dealers, and museum professionals are guaranteed a living wage.

In its "womanifesto," W.A.G.E.'s feminist founders express a mission to "draw attention to economic inequalities that exist in the arts" resulting from "the organized irresponsibility of the art market and its supporting institutions"; specifically, "the refusal to pay fees for the work we're asked to provide: preparation, installation, presentation, consultation, exhibition and reproduction." The W.A.G.E. manifesto calls out a system that positions "the artist as a speculator," and serves as a call to arms, demanding "the remuneration of cultural value in capital value."

In 2014 W.A.G.E. developed a multi-tiered "artist's fee calculator," which establishes an industry-wide minimum "Floor W.A.G.E." for fourteen common types of unpaid creative labor. These rates scale based on a fixed percentage of an institution's total annual operating budget, and eliminate disparities in payment driven by gender, medium, and project budgets. In 2014, the group also launched its W.A.G.E. Certification program, to recognize U.S. arts organizations that have voluntarily agreed to pay artist fees at or above Floor W.A.G.E. minimums; at present, fifty-two organizations comply. Future planned initiatives include WAGENCY, a coalition that works with artists to negotiate payment according to W.A.G.E. standards, as well as an artist's transfer and sale agreement that ensures financial compensation for artists when their work changes hands on the secondary market.

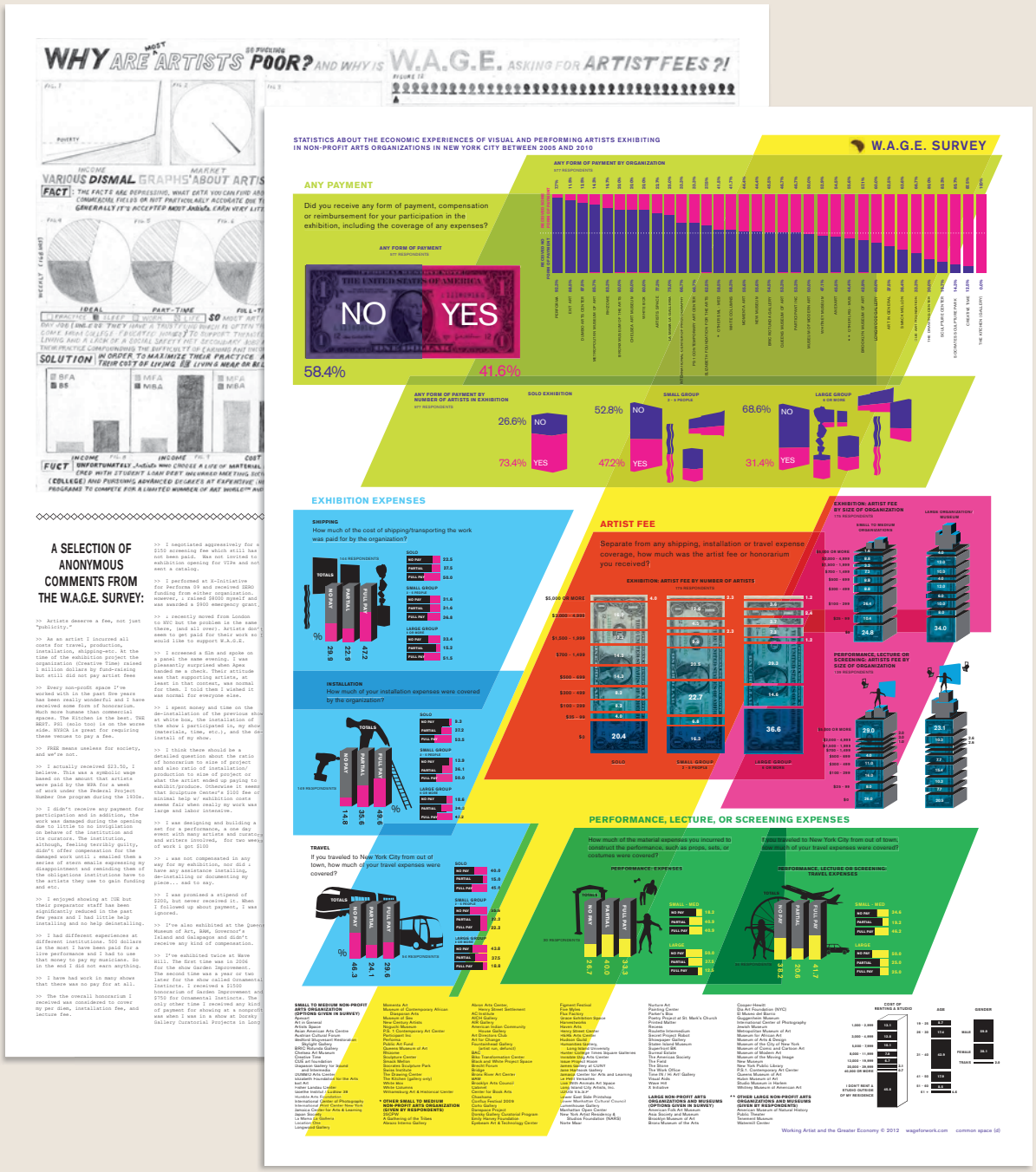
According to survey data released in 2016 by the U.S. Bureau of Labor Statistics, jewelers and precious stone and metal workers earned a median annual wage of $38,200, with the lowest ten percent of respondents making less than $22,060 per year.

In a 2010 W.A.G.E. survey on payment practices, 58.4% of the nearly 600 responding artists who exhibited at NYC-area non-profit institutions from 2005-2010 indicated they received no form of compensation for their participation or expenses.

While W.A.G.E. was established and continues to run primarily as an advocacy group for visual artists, several craft-centric organizations have found W.A.G.E. Certification a useful tool in ensuring the fair payment of their exhibiting artists and other constituents. The Weavers Guild of Minnesota, one of the country's oldest and largest groups dedicated to advancing and preserving the arts of weaving, spinning, and dyeing, became W.A.G.E.-certified in 2017. The working artists who teach its classes, give lectures, write articles, and run workshops are paid according to W.A.G.E.'s guidelines, and the guild negotiates W.A.G.E. fees for its members who exhibit work at external venues. "As an organization with a long history and leadership role in the weaving community, the Weavers Guild of Minnesota felt it was important to set the standard that paying artists is important in all sectors of the arts," Executive Director Beth Bowman asserts. "Many of our constituents are essentially small business owners making and selling their works just like visual artists, and deserve similar compensation for their time and talent." Chicago's Threewalls Gallery, founded in 2003 by contemporary crafts curator Shannon Stratton (now William and Mildred Lasdon Chief Curator at the Museum of Arts and Design), became W.A.G.E.-certified in 2015. "I don't see a reason to draw differences between an artist making paintings or an artist making videos or an artist making jewelry," Stratton notes. "If they are exhibiting in a non-for-profit, museum, etc., it's up to those venues to establish a fee schedule for exhibiting artists of any discipline, and it should be the same for all exhibitors."

Artist Lise Soskolne, an organizer within W.A.G.E. since its founding and its core organizer since 2012, finds that smaller exhibition spaces have more readily gotten on board with the group's mission, in part because they remain "more connected to their roots and to the reasons they actually formed in the first place, which is usually to support other artists." Even though Floor W.A.G.E. fees for institutions with annual operating budgets under $500,000 are relatively affordable, committing to W.A.G.E. Certification can require budget restructures and appeals to funders. "The fee calculator and the certification guidelines actually provide an opportunity

Common Space Studio
W.A.G.E. Survey, 2012 (front and back)
poster
Courtesy of W.A.G.E.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W.A.G.E. SURVEY
ANY PAYMENT
Did you receive any form of payment, compensation or reimbursement for your participation in the exhibition, including the coverage of any expenses?
NO
YES
58.4%
41.6%
EXHIBITION EXPENSES
SHIPPING
How much of the cost of shipping/transporting the work was paid for by the organization?
INSTALLATION
How much of your installation expenses were covered by the organization?
TRAVEL
If you traveled to New York City from out of town, how much of your travel expenses were covered?
ARTIST FEE
Separate from any shipping, installation or travel expense coverage, how much was the artist fee or honorarium you received?
PERFORMANCE, LECTURE, OR SCREENING EXPENSES
How much of the material expenses you incurred to construct the performance, such as props, sets, or costumes were covered?
If you traveled to New York City from out of town, how much of your travel expenses were covered?

for organizations to articulate what their fiscal needs are," Soskolne observes.

Craft guilds once protected the interests of skilled artisans by regulating markets and ensuring the ongoing economic viability of their members' vocations. The social and economic power of the guild system peaked during the Renaissance period, only to collapse with the tide of industrialization that swept across the Western world in the 19th century. Aligning with W.A.G.E. to demand payment for commissioned content presents one model through which crafts workers could help build a coalition for economic reform and a more just redistribution of resources. This struggle also intersects with other critical issues facing the field of jewelry and metalsmithing, such as the use of ethically sourced materials. Soskolne makes W.A.G.E.'s position plain: "By not demanding to be paid, not only do you enable yourself to be exploited by the art system, you also support the consolidation of wealth by it."

Luke T. Baker is a writer, design historian, and curator based in New York who has written for The Museum of Modern Art, Metropolis, *Prada,* Modern, The Magazine Antiques, Art Papers, *and* The Studio Potter.

Data from the W.A.G.E. Survey and other resources are available online at www.wageforwork.com.

TECH TOOLKIT

Measured Vignettes: Calipers

A reminder that a simple tool can have a big impact.

BY GABRIEL CRAIG

I was tasked with cleaning out the lockers in the metal studio at the end of the school year. I had my pick of the spoils before turning the debris over to the upperclassmen. The contents of fifteen lockers—ramshackle remains of mandatory tool kits, half-completed projects, and crumpled bits of 600-grit sandpaper—lay strewn about. Among the grobet stainless six-inch rulers and #2 cut half-round files lay a pair of brass calipers. A caliper rule, to be exact; but no one really calls them that. It's not part of the standard tool kit, or else there would have been more of them abandoned on the table. It noted inches on top, millimeters on the bottom, and was simply labeled "METER." "Made in Germany," it read, returning to proper letter case. This was a good tool, machined and stamped with nice, tight action. I flicked the calipers open and snapped them shut with the ease of operating a Zippo before dropping them into my pocket.

Five years on, these vernier sliding brass calipers (made by Gesswein, which I only discovered was their manufacturer when writing this article) have served me well. They are great for measuring stones, material thickness, and sometimes ring blanks, small parts, and tolerances. I have made a gradual transition into steel work, and they are now indispensable for measuring hardware, fasteners, machined parts, stock sizes, and checking forged parts. I was at the Metal Museum in Memphis for a brief spell and discovered a pneumatic engraving machine in their shop. I conducted exhibition business during the day, but spent my evenings engraving every stray piece of brass and copper I could find. With little scrap at hand, on my final night in Memphis I cannibalized my Gesswein vernier sliding brass calipers.

With their humble origin, hyperfunctionality, and aftermarket modification, they have come to represent the most essential tenets of craft for me: function and beauty.

Our shop has had a robust internship program for five years. Each intern has traveled a unique path from across the country to Detroit. Last February, an intern handed me incorrectly cut and marked parts. The next day I drove to the local jewelry supply and procured a pair of brass calipers that were boring, basic, and utterly essential to the business of being a metalsmith. I sat down at my pneumatic engraver and gave them character. I ornamented them so that this intern—and the rest of the interns and employees from then on—would not only have an essential tool to aid them in their craftsmanship, but also an embellished tool, bathed in the beautiful frivolity of ornament that pervades the work we do.

My calipers have journeyed with me for two-thirds of my career now. I don't know what I'd do without them. They sit right over my heart, on the left side of my apron, in a pocket specially made for them. With their humble origin, hyperfunctionality, and aftermarket modification, they have come to represent the most essential tenets of craft for me: function and beauty.

Gabriel Craig is a metalsmith, writer, craft activist, and co-owner of Smith Shop in Detroit, Michigan. The author learned what the vernier scale was while researching and writing this article. The calipers in question appear to be, even now, getting better all the time.

Craig's Gesswein vernier sliding brass calipers, complete with engraved modifications.

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Bowl overlay by James Miller, hand cut with
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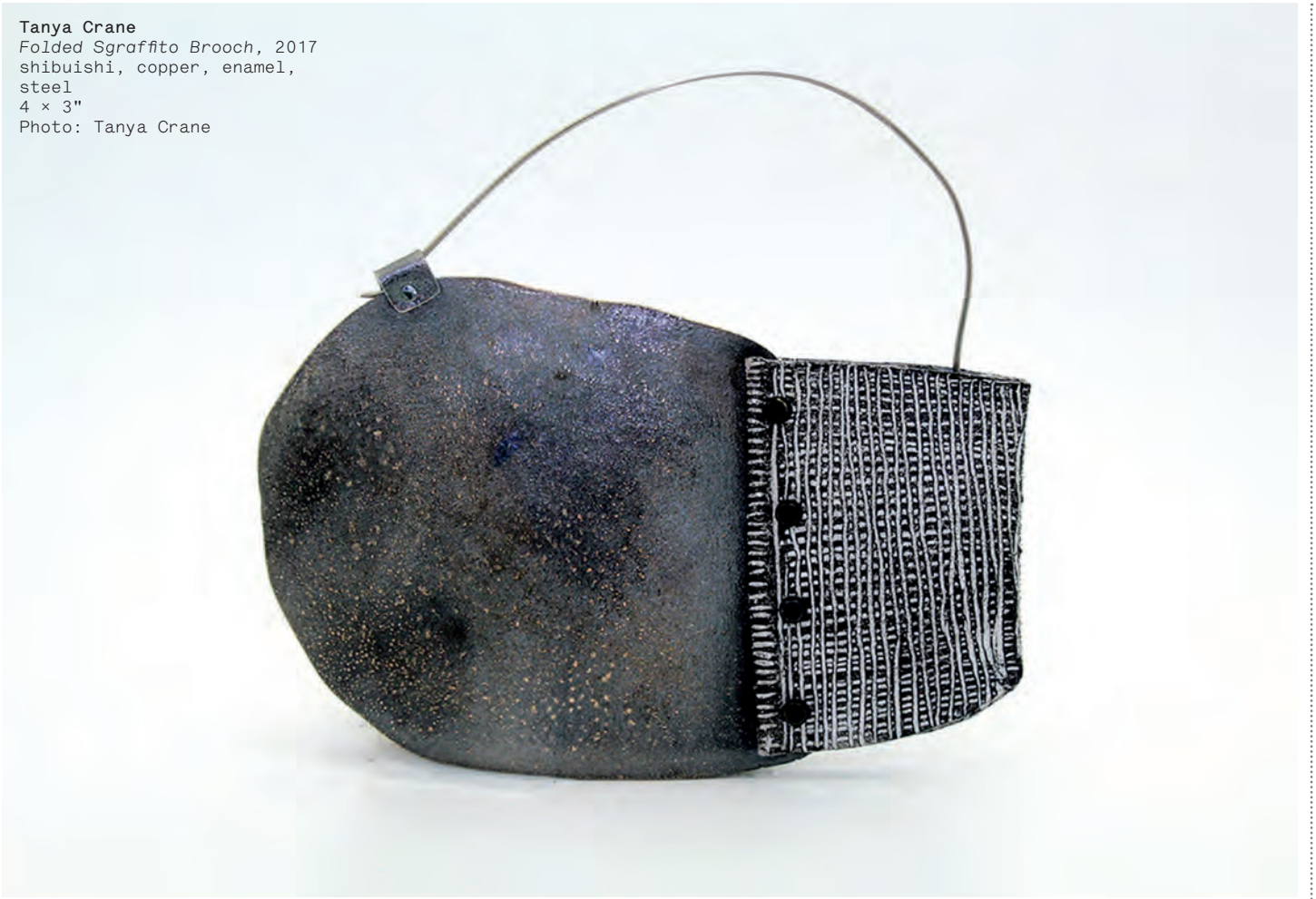

Tanya Crane
Folded Sgraffito Brooch, 2017
shibuishi, copper, enamel, steel
4 × 3"
Photo: Tanya Crane

TECH TEACH

Nomadic Pastoralism

An artist finds inspiration by bringing traditional training to an interdisciplinary teaching environment.

BY TANYA CRANE

I have had the privilege of a nomadic existence. For some, moving from city to city and state to state every two years for more than two decades might seem daunting. For me, this kind of movement has exposed me to triumphantly diverse makers, teachers, landscapes, and cultures. Through these experiences, I have come to realize that I am extremely adept at adapting, and assimilating my newfound realities into my art. There is always a new food, building, or music that has the capacity to inspire a piece of jewelry. Fresh and fecund interactions make me question my ways of making. They also challenge my perspectives and interpretations, which ensures fluid thought processes and keeps hubris at bay.

Only a few months after finishing graduate school, I found myself on a new academic adventure: teaching at the School of the Museum of Fine Arts, Boston at Tufts University. Having come from two very traditional metals programs, SUNY New Paltz and University of Wisconsin–Madison, I found myself in a school whose mission is to provide a truly interdisciplinary art education to its students. For me, that meant taking the linear system of a traditional jewelry program, intended to provide foundational knowledge and techniques, then extrapolating these fundamentals through experimentation with materials, as well as ways of making.

I would ask the students when learning how to pierce and saw metal to bring in materials from their environments. This meant items from their dorms, natural materials that they found on their walk to school, grocery-store items, and, most importantly, discarded material they found in our very large Dumpsters. From this point of departure, the students would make the skill samples I required, but also make creatively connected assemblages of materials. Through these exercises, jewelry and small sculptures would emerge, imbued with thoughtful intent. I had one student who made phallic forms with crushed windshield glass, glue, and fiber. Occasionally he would adhere these materials to metal, but mostly he used the context and setting of a jewelry class to make small sculptures that referenced raised vessels, a traditional metalsmithing artifact. Another student took bronze casting grain and embedded a small amount into an alginate mold. From there she poured cement into the mold and created a series of rings. These cement rings featured casting grain as stone, and stone as metal. These moments, when one material references another, are the desired effect, and not isolated instances.

These experimental modes of making are a constant in my classroom. I find it an exhilarating way to spend my time as

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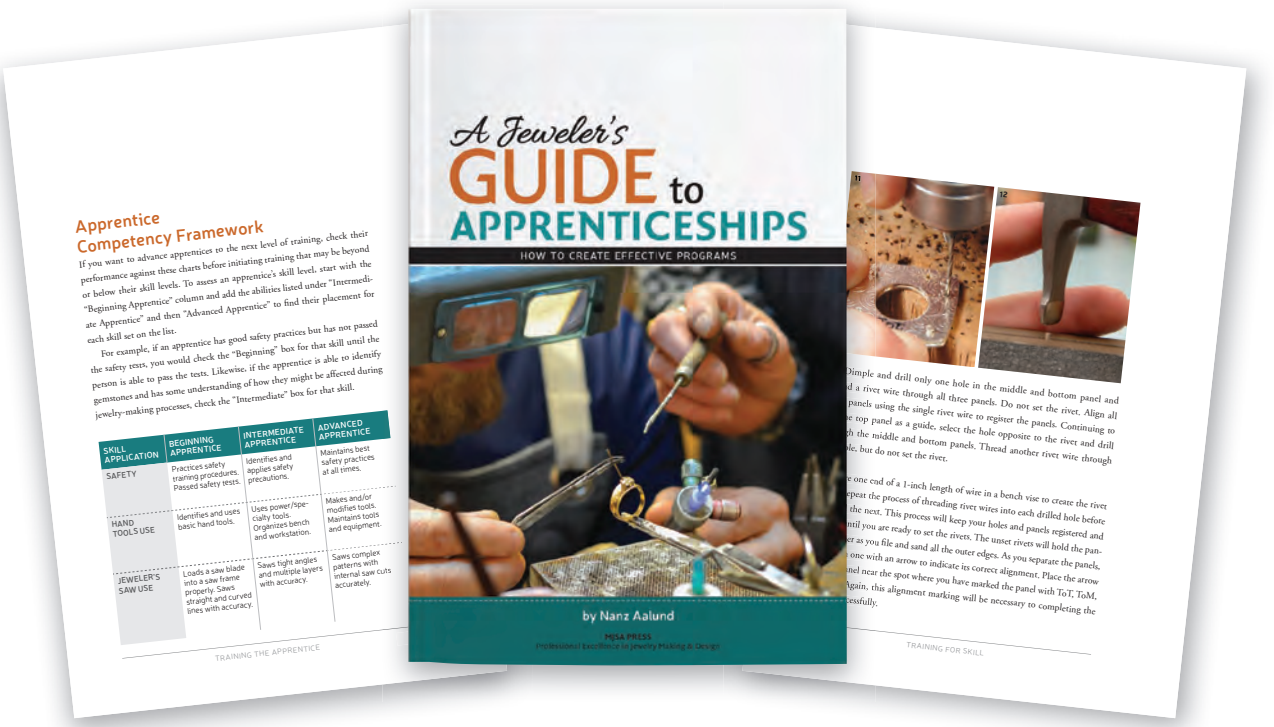
Apprentice Competency Framework
If you want to advance apprentices to the next level of training, check their performance against these charts before initiating training that may be beyond or below their skill levels. To assess an apprentice's skill level, start with the "Beginning Apprentice" column and add the abilities listed under "Intermediate Apprentice" and then "Advanced Apprentice" to find their placement for each skill set on the list.
For example, if an apprentice has good safety practices but has not passed the safety tests, you would check the "Beginning" box for that skill until the person is able to pass the tests. Likewise, if the apprentice is able to identify gemstones and has some understanding of how they might be affected during jewelry-making processes, check the "Intermediate" box for that skill.
SKILL APPLICATION
BEGINNING APPRENTICE
INTERMEDIATE APPRENTICE
ADVANCED APPRENTICE
SAFETY
Practices safety training procedures. Passed safety tests.
Identifies and applies safety precautions.
Maintains best safety practices at all times.
HAND TOOLS USE
Identifies and uses basic hand tools.
Uses power/specialty tools. Organizes bench and workstation.
Makes and/or modifies tools. Maintains tools and equipment.
JEWELER'S SAW USE
Loads a saw blade into a saw frame properly. Saws straight and curved lines with accuracy.
Saws tight angles and multiple layers with accuracy.
Saws complex patterns with internal saw cuts accurately.
TRAINING THE APPRENTICE
A Jeweler's
GUIDE to
APPRENTICESHIPS
HOW TO CREATE EFFECTIVE PROGRAMS
by Nanz Aalund
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11
12
Dimple and drill only one hole in the middle and bottom panel and
d a river wire through all three panels. Do not set the rivet. Align all
panels using the single river wire to register the panels. Continuing to
e top panel as a guide, select the hole opposite to the river and drill
h the middle and bottom panels. Thread another river wire through
le, but do not set the rivet.
e one end of a 1-inch length of wire in a bench vise to create the rivet
epeat the process of threading river wires into each drilled hole before
the next. This process will keep your holes and panels registered and
til you are ready to set the rivets. The unset rivets will hold the pan-
er as you file and sand all the outer edges. As you separate the panels,
one with an arrow to indicate its correct alignment. Place the arrow
nel near the spot where you have marked the panel with ToT, ToM,
gain, this alignment marking will be necessary to completing the
essfully.
TRAINING FOR SKILL

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Olimpia Saxe-Coburg
Cement Ring, 2016
cement, bronze casting grain
Dimensions variable
Photo: Olimpia Saxe-Coburg

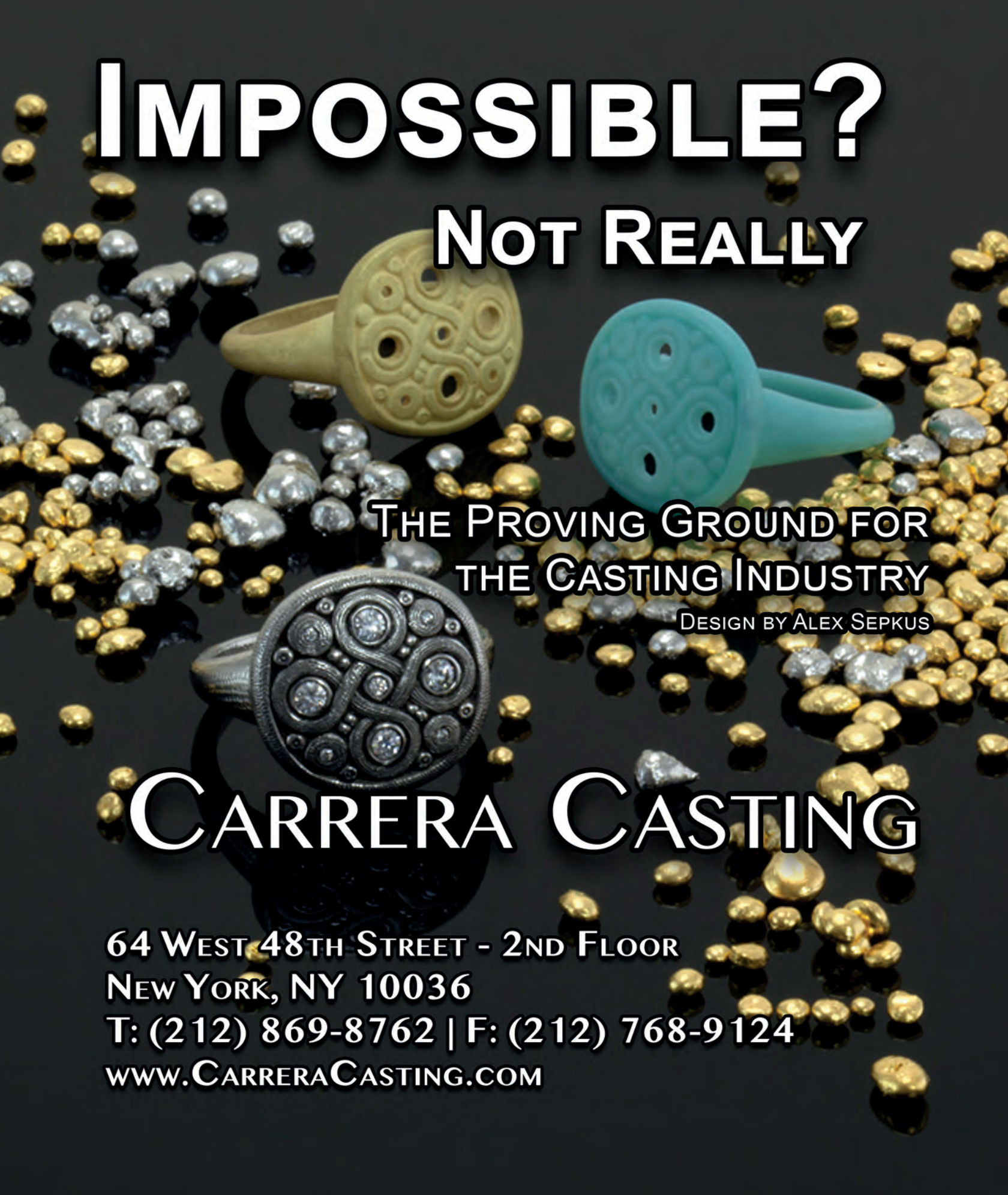
Blake Oliva
Orange Highbeam, 2017
low carbon steel, high gloss varnish spray paint, rubber straps, canvas straps, resin
20 × 10"
Collection of Efharis Alepedis
Photo: Paulina MacNeil

a teacher; of course, these experiences have found their way into my jewelry and sculptures as well. After moving to New England, I found myself inspired to dig into the deep and robust history of American industry, starting with the American industrial revolution at Slater Mill and continuing through to present day. New England's history has also made me more aware of cultural artifacts, and more specifically those of African slaves and their migration throughout America.

Having grown up in Southern California, I was used to mostly mission-style buildings and stories of the American West. Now I am surrounded by old brick mills in various states of decay and an incredibly diverse mix of cultures. My work now is both informed by my new environment, and by the excitement and experimentation of my students. After spending eight hours a day teaching in an interdisciplinary environment, when I come home to my studio in a century-old creamery building, I can't help but draw from these visual cues and insert them into my work.

Reflecting on my experiences as a maker of jewelry objects, it seems that the journey—including what is learned through teaching others—is always reflected in the work. The call to use materials that reference the industry that made them has become my most important concern. I seek materials that reflect the cultures they reference, and I am not overly concerned with whether I am using traditional metalsmithing techniques—and I encourage my SMFA students to do the same. I am lucky to spend so much time in this interdisciplinary teaching environment, which allows me to cultivate a mutually beneficial relationship with my students.

Tanya Crane received her MFA in Metalsmithing and Jewelry from the University of Wisconsin–Madison in 2015, and her BFA in Metal from SUNY New Paltz. She is a part-time lecturer in Metals at the School of the Museum of Fine Arts, Boston at Tufts University and a critic in sculpture at Rhode Island School of Design.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STUDIO VIEWS

Starting Your Studio for $500 or Less: A Guide

BY DIANNE DEBEIXEDON

A STUDIO IS A PERSONAL SPACE, built slowly and thoughtfully to suit your style of working. Making the transition from a teaching space to a personal studio can be overwhelming—and expensive. Most of us learn our craft in a spacious classroom full of benches, tools, equipment, and supplies. However, when leaving that environment and looking to establish a studio, artists typically face thousands of dollars of expenditures, often at a time in their career when resources are limited. There needs to be a cost-effective, practical way to replicate what was previously provided by an academic setting.

MY BEGINNING

After my graduation, I moved to a beautiful area in rural Georgia about sixty miles from the nearest metropolis. I didn't anticipate the feeling of artistic isolation from fellow smiths, nor the profound effect of losing a working studio. If I were to continue in metals, it was obvious that I not only had to create my own space, but also reconnect with the metalsmithing community.

The Internet was not as pervasive as it is today, but SNAG was there. It became, and remains, my connection to our "tribe" of artists. As a teacher, my students are faced with the same dilemma I confronted—with the additional complication of a plethora of information online. It can be so overwhelming that it's almost impossible to know where to begin.

Each semester, I speak with students individually to discuss how to develop a brief strategy for space, equipment, tools, and supplies, customized to the way they work. Based on my experience, I try to offer my students a suitable and attainable approach. With limited financial resources and outstanding college loans, I found creating my first studio to be a slow build.

The first item on my list was locating a usable space: *Working space is a tool.*

To even begin, I had to formulate a strategy that would focus on priorities. While some choices seemed obvious, I devised a list of needs, with attention to the *absolute minimum required* to create a working space—my personal bottom line. Next were items that could be put off for a few years, when I might broaden my repertoire. Working further down the list, I identified the higher-quality tools, equipment, and facility features that I would need in the years to come.

A funny thing happened along the way. As I proceeded toward my goals, my needs diverged from my intended inventory. For example, casting equipment was initially at the top of the list. However, I changed direction artistically, and it fell to the bottom. I never dreamed that a longing for casting equipment would be replaced by a longing for a forge and a Peter Wright anvil! Several criteria guided my changing priorities. Some were based on my perception of whether a tool, equipment, or space was an investment that would serve me well into the future, or whether a less expensive alternative with an acceptable reduction in quality would meet my needs. Sometimes I decided that making the tool myself would be a better option than buying. Balancing planning with allowing my list to evolve in real time helped me evaluate decisions.

GETTING STARTED WITH SPACE

The first item on my list was locating a usable space: *Working space is a tool.* My first studio was a small, narrow back porch. Fortunately, jewelers can often work in compact spaces such as a basement, garage, shed, or rented space, with a basic workbench and a table for soldering. The few tools I had consisted of a saw frame, two hammers (both of which I still have), assorted files, and a small mushroom stake. I was fortunate to own a torch tank setup, a required purchase as a student. I had grumbled about the cost at the time, yet as I set up this first studio I was grateful. When considering a space, keep in mind adequate ventilation, lighting, safety, and access to water.

My second priority was finding suitable work tables for bench work, soldering, and equipment. Using large, heavy tables and stumps drove me crazy! The tables had to be braced, which

The working table in schematic below, and in DeBeixedon's studio, at right.

required a large footprint and wasted valuable space. After years of struggling, I changed my criteria and used smaller custom-built tables. I designed a small basic table made from 2x4s and 2x6s that is sturdy, heavy, and easily moved on a hand cart. The drawing on this page shows how the table was put together, and it can be any dimension depending on the size of your materials. Using only two cross braces allows the space under the table to remain accessible. Since the tables can be configured side by side, staggered, or separated, they easily accommodated moving into my sixth studio a few years ago. The small tables—four now in total— fit this new space easily. Underneath, I store heavy tools, pitch posts, steel blocks, and sandbags. With the added heft, they weigh close to 200 pounds, giving me a table strong enough to mount vises, rolling mills, stakes or buffing wheels. Even with the constant hammering during raising, the table stays in place. There's just no substitute for mass!

A safe table for soldering is another essential consideration. The surface, which might be covered with solder board, charcoal, or fire bricks, must be able to withstand the intense heat of a torch for soldering and annealing. The soldering table I have been using for many years is custom-made (by my talented spouse!) and surfaced with small 2x2 ceramic tiles. The

THE CHECKLIST

Without knowing an individual's working style, it is difficult to devise a specific list that meets the $500 budget. However, these recommendations are general guidelines when creating a studio. A "◊" symbol by an item means that it could be found second-hand at a flea market, garage sale, thrift store, discount hardware provider, or drugstore.

MUST HAVE HAND TOOLS

- Files: Ring file, bastard file, needle files, Magicut file for steel, file cleaning brush ◊
- Bench blocks: steel and rubber
- Brushes: brass (fine bristles) and steel bristles (small gun-cleaning type)
- Center punch
- Cutters: flush cutters, heavier duty wire cutter (hardware) scissor or shears
- Hammers/Mallets: Chasing, rawhide, planishing, forging (midweight) brass dead blow ◊
- Loupe and/or other magnifying glasses, optivisors
- Mandrels: round ring, large for bracelet
- Metal dapping set with a large variety of punch sizes ◊
- Pliers: flat nose, round nose, chain nose ◊
- Ring gauge
- Safety goggles
- Saw frame (adjustable) with tension screw for blade
- Stone setting: stone setting tools, burnisher and scraper

SOLDERING TOOLS AND SUPPLIES

- Bowl for water ◊
- Copper tongs
- Crock/pickle pot ◊
- Soldering pick(s) (A 36 steel/1/8–1/4 inch)
- Soldering blocks, charcoal, bricks
- Sparker/lighter
- Torch (propane or acetylene)
- Tweezers

GENERAL SUPPLIES

- Beeswax
- Binding wire
- Buckets ◊
- Epoxy
- Flux
- Grinder ◊
- Ivory bar soap, Castile soap, and Dawn. Use Ivory soap or Castile for tumblers
- Liver of sulfur and/or Silver Black
- Microcrystalline wax
- Polishing compounds
- Polishing cloth

- Rags ◊
- Sandpaper (various grits), scotch bright and 0000 steel wool
- Scissors ◊
- Sharpies
- Solder snips
- Solder: hard, medium, easy, extra easy (cadmium free)
- Sparex #2 pickling solution
- Toothbrushes ◊
- Yellow ochre

DIY: TOOLS THAT IT PAYS TO MAKE YOURSELF

- Bench pin
- Burnisher
- Center punch
- Chasing tools
- Hammers: make out of wood, bone, or plastic
- Jump ring mandrels: make from 01 or W1 steel
- Mandrels: large for bracelet (large diameter PVC pipe)
- Scraper
- Soldering pics
- Stone setting tools

IF YOU'RE FEELING FLUSH: INVESTMENTS IF YOU HAVE MORE THAN $500

The tools below are suggestions of "investment" acquisitions which might be either future purchases, or secured used and in good condition, but which may not fit in a $500 budget.

- Anvil: 55 lbs ◊
- Bench Shear
- Casting Equipment: Centrifuge, burnout kiln, and accessories
- Doming Block and punch set
- Drill Press (large)
- Drill Press (small table top)
- Flex Shaft and motor attachments
- Polishing unit
- Rolling mill
- Tumbler/polishing machine
- Ultrasonic cleaners
- Vises ◊

tiles are easy to clean and repair, and protect the top from heat transference. Soldering board is placed on top of the tile, where I created a firebrick surround to contain the heat.

TOOLING UP

Determining which hand and power tools were an absolute necessity was my next challenge. For tools that are essential but expensive, I recommend regular visits to flea markets, garage sales, estate sales, and thrift stores, looking in particular for quality used files and rasps (which can be cleaned in a 50/50 solution of vinegar and water), stainless steel pots and pans for chemicals, pliers, hammers, and C-clamps in all sizes. One of my favorite finds when I was setting up my studio was a 1950s Craftsman grinder, purchased for $5 to "make do" until I could invest in a quality machine. I fixed the safety shields, painted it in the original color, and twenty years later, the "make do" grinder is a permanent member of the studio.

The ability to harden and temper steel provides the opportunity to custom-make tools that are not commercially available, made in the size or weight you need. While it may seem as if you are wasting time and money making tools, by making your own you become a more discerning buyer and recognize quality in the work of others. Students in my classes learn how to forge, grind, anneal, harden, and temper a few basic types of steels, then craft their own tools for chasing, burnishing, stone setting, chain making, waxing, and custom soldering pics. Some tools function much more effectively if they are formed to specifically to fit your hand, or they might not be commercially available in the size you need. Burnishers, for example, are important for stone setting, but are only available in one or two sizes in standard shapes. However, you can make small burnishers in different shapes, with a curve perfectly suited for chasing or stone setting. I particularly like to make some wax tools out of wire hangers because the cheap steel holds heat so well. There is a particular joy in using a custom chasing tool with a slight twist to fit your thumb placement.

Some of my favorite tools were just scrounged and repurposed. A few examples were gifts from friends. One was a shallow cigar box that I filled with soft microcrystalline wax, into which I press small items; I use it as a holding device that won't scratch or mark the metal. I was also given a large steel theater curtain weight that I adapted for shallow chasing. A large discarded piece of Corian cut out from a kitchen sink counter is one of my favorites. I use it as a work surface on top of my bench. The Corian has a smooth matte finish that can be kept immaculately clean. I can draw or put notes in pencil on the surface while I am working, which later

Right: DeBeixedon's 1950s "make do" grinder purchased when she first set up her studio, and still in use.

Tools are everywhere, if you know how and where to look.

can be easily removed with a mild cleanser. Tools are everywhere, if you know how and where to look.

MONEY MONEY MONEY

Your creativity can provide many workarounds when a tool is out of reach financially. Years ago, I needed a curved surface for cold forming. A large anvil or mushroom stake was not an affordable option. Instead, I purchased a bowling ball in a thrift store for under $10 and an unmounted lawnmower tire. By placing the bowling ball in the tire for stability, I had the large curved surface I needed! Later I made a freestanding base for the bowling ball, which I use to this day. Even though I now have an anvil, sometimes only the bowling ball gives me the curve I need.

When considering making a long-term investment, it may not be cost effective to purchase more quality than you need. Likewise, "knock-offs" may serve you well in the near term. I frequently peruse discount hardware stores, where I've bought inexpensive vises, dental tools for wax work, a dapping set with block (quite nice), dead blow brass hammers for stamping, needle files, C-clamps and a small 55-pound anvil. When I acquired an antique Wilton and Charles Parker vise to replace two good but lesser quality "knockoffs," I gave them to people just starting out. In contrast, anvils for me are an investment purchase, and I did not buy second rate. For most of my students, a Harbor Freight anvil is a perfect match in size and quality.

SHOP TALK

Talk to other metalsmiths online, at conferences, symposia, and any gathering. We've all created studio spaces, and other smiths are likely to have ideas, solutions, and suggestions that will serve your situation. Talk to vendors as well. I owe a debt of gratitude and appreciation to the vendors that SNAG has worked with over the years. All of them have generously offered their knowledge and expertise directly or indirectly to us, to help set up our studios and become practicing metalsmiths and artists.

Dianne deBeixedon studied metals at Southern Illinois University and the University of Georgia before beginning her career as a professor at Old Dominion University in Norfolk, Virginia. She began the metals program, now fully equipped in a new studio building, with few tools in a damp classroom under the football stadium.

Author Portfolio

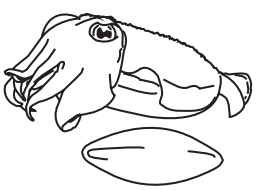
Dianne de Beixedon
Shape Shifting Camouflage, 2015
niobium, sterling silver, fine silver, titanium druzy (chasing and repoussé)
4 × 2 × 2"
Photo: Eric Lusher

Dianne de Beixedon
Octopus's Garden in the Shade, 2017
copper, pewter (chasing, repoussé, forging, patination)
22 × 10 × 7"
Photo: Eric Lusher

THE NEXT GENERATION

Cuttlebone Casting for Teachers

BY JIM BOVÉ



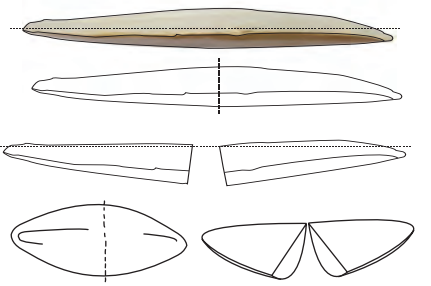
THIS ARTICLE IS INTENDED as a teacher's guide to cuttlebone (sometimes called cuttlefish) casting for grades six through twelve, ideally for a group of up to twelve students. Cuttlefish are squidlike marine animals with a central shell called the cuttlebone, which we will use for the project. The cuttlebone provides the cuttlefish with its buoyancy. You'll most commonly find cuttlebone in the pet aisle of the grocery store as a source of calcium for pet birds—but, if you're in the right part of the world, you'll find them washed up on the beach!

Cuttlebone casting will teach your students how to plan a design for casting, carve a mold, cast, saw, file, and finish a work of art. Because the mold itself is carved away to create the form for the artwork, the process emphasizes subtractive techniques, as opposed to the additive process generally found in clay sculpture lessons. This is an especially useful project for collaborations with physics, applied engineering, and earth science teachers. The casting process is an excellent crossover from STEM into STEAM, and shows how closely related the arts and sciences really are.

I have taught cuttlebone casting to students as young as age twelve. While students in this age range may be nervous at first, they love the casting process once they try it. Casting using cuttlebone is affordable, even on limited school budgets. While this tutorial is intended for the beginner, a basic familiarity is assumed for some jewelry processes (sawing, filing, and soldering).

PREPARING THE CUTTLEBONE

Due to the natural curve of the cuttlebone, a lot of material will have to be removed in order to flatten out the length of the bone. Unless you plan to do a very long cast, cut the cuttlebone in half first. Each half can then be flattened to provide a thicker cross section, allowing a deeper, stronger mold.



Since cuttlebones are very soft, they can be easily cut with a jeweler's saw using almost any size blade. A band saw can be used to save time, but—depending on student comfort or class time limitations—you may want to do the prep work in advance. Next, sand the soft side flat. The soft part of the shell is what we will be carving into. Use a figure-eight or X pattern to ensure that the cuttlebone is evenly sanded. Coarse sandpaper (such as 180-grit wood) works especially well. You can rub the two halves of the cuttlebone together to smooth them, but I find that this raises more dust and makes it harder for students to get the halves perfectly flat. Wearing dust masks while sanding is recommended. Figures 1 and 2 show the cuttlebone before and after sanding. The cuttlebone is cut in half and the soft side is sanded smooth.

1

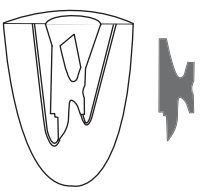
2

DESIGNING YOUR ARTWORK

Once the cuttlebone has been prepared, students will have a better idea of their canvas and the size limitations for their designs. I suggest leaving a quarter-inch buffer zone around the edge, measured

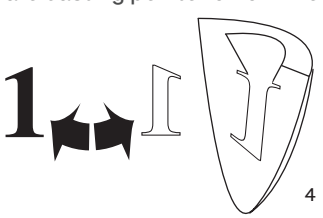
from the flattest part, not from the edge of the bone itself. This will ensure that metal does not break through during the metal pour. Have students place the cuttlebone flat side down on paper and trace it so that they have an accurate design space (measure in from the tracing to create the buffer zone). Or, create a sheet of cuttlebone outlines so students can produce their designs, like this simple anvil, as homework.

Next, plan how the metal will flow into the mold. Since this will be a gravity pour, the best way is to determine if the metal will flow into all of the parts is to turn your design upside down. Ask students to imagine: If the mold were filled with water, would all the water be able to pour back out? Students should lay out their design with proposed sprues and vents, as in Figure 3.



3

Images will be backwards as in Figure 4, so have students reverse any type they might want to use by flipping their design over and using a light table or a window to trace it. Designs can be drawn directly onto the cuttlebone using pencil. While there are many ways to sprue and vent, experimentation is part of the process. Sometimes no vents are needed, as the cuttlebone is very porous. While I have seen vents that go right out of the sides and bottom of the mold, I would avoid those. Metal can leak out, especially if you are casting pewter or low-melting metals.



4

CREATING YOUR DESIGN IN THE CUTTLEBONE

Cuttlefish bone is very soft. It can be easily carved and objects can be pressed into it. Soft brushes are used to accentuate the cuttlebone texture. Careful carving with a polished tool can produce very smooth textures. If you press down with a polished tool to compact the cuttlebone material, it will give a smooth finish. Alternatively, you can use a soft brush to remove the soft part of the cuttlebone to accentuate the natural texture. When creating the design for casting, you might also think of what can be pressed into the cuttlebone to create shapes. Flathead and Phillips-head screwdrivers make great patterns, and there are a whole range of shapes that can be found in the hardware store that can be pressed into the cuttlebone. Just remember that everything must connect, so that the metal can flow from one section to the next!

When pressing a shape into the cuttlebone, the soft bone material may become compacted, and it is too hard to push further without risking breaking the bone. In this case, you should scrape away the compacted material before going any further. Sometimes you must press and then scrape away repeatedly before reaching the desired depth of impression. The pattern shown in Figure 5 was made by pressing in a premade shape, first carved out of hard wax. Vents radiate out from the design to allow air to move quickly away, and a generous sprue will allow the metal to enter the mold quickly. Try to keep designs at least an eighth of an inch thick. Students can use a quarter or nickel to press into the cuttlebone if they are making round charms to give a good depth before they start carving a design within the circle.

5

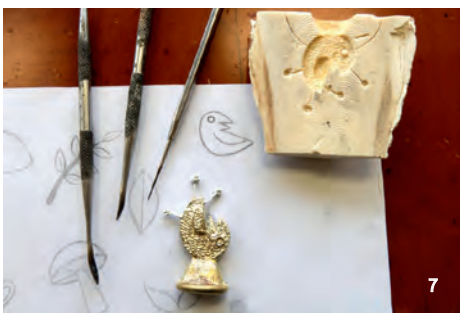
PREPARING TO CAST

When using higher melting temperature metals, a cuttlebone cast allows for one pour. Once the molten metal is poured in, the mold is burned away. Lower melting temperature metals, like lead-free pewter, do not burn the mold and can be used several times. Be sure not to have undercuts if you want to make multiples.

The piece in Figure 6 was cast in bronze; the mold is no longer usable.

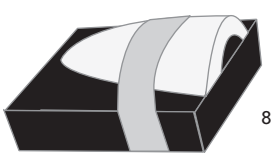
6

The piece in Figure 7 was cast in pewter, the mold can be reused. This image shows the tools used by a student to create a cast in pewter. She rotated her design so the sprue would be at a wide part and the metal would flow naturally into every area.



7

When creating a one-sided cast, in which a student carves into a single cuttlebone and the back is flat, I prefer to use a hard-charcoal block, as shown in Figure 8. The traditional method is to use another cuttlebone, but this wastes that material. Instead, the charcoal block can be reused and, if handled by the edges, can be picked up as soon as the color has drained from the metal. You can use masking tape instead of wire to secure the two halves of the mold, as the tape will survive the cast, is cheaper and less wasteful than wire, and students tend not to crack the cuttlebone (as they do when tightening wire). Just be sure the tape is tight when you wrap it all the way around the mold, so it overlaps. By beginning and ending the tape on the back of the charcoal block, it will be easy to undo after the cast. Always make sure that tape is touching tape, as the powdery surface of the charcoal does not allow for good surface contact.



8

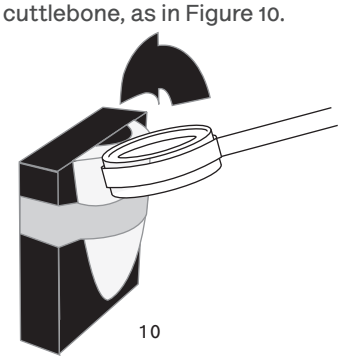
Once the cuttlebone is taped to the charcoal block, check to make sure it is tight by gently pulling on the cuttlebone; there should be no movement. Next, hold the block up to the light and look for any gaps. If you see any light showing through, there is a gap and metal will run out. Fix this before casting!

CASTING

A simple casting setup can consist of a torch that gets hot enough for the metal you choose. We use an oxyacetylene setup with a brazing tip, but you can use an acetylene torch for silver and small amounts of bronze, or even a small Bernzomatic torch setup from the hardware store if you are using pewter and small amounts of metal. You also need a crucible with handle for melting the metal in and pouring it, and a fireproof table setup with a pebble tray to support the mold and catch any overflow metal.

9

While seemingly the most difficult part, the casting itself is actually very simple. Place your metal in the crucible. It is fine to eyeball the amount you will use, and better to melt a little more metal than you will need so that you don't run out mid pour. Just stop pouring once the mold is filled. You can use a little borax as a flux when melting the metal. No matter which metal you choose to use, make sure it is fully melted. It should "pillow," or have good surface tension and no resistance when a stirring rod is passed through it. Once the metal is fully melted and ready, place the crucible lip to the lip of the cuttlebone, as in Figure 10.



10

Keep the torch flame on the leading edge of the metal the entire time. Once you start pouring, do not stop. Even if you have to make a slight correction, it is better to pour in one smooth, fluid motion. This is why a pebble tray is very important. It not only supports your cuttlebone, but will catch any metal that does not make it into the mold.

For silver or bronze: Once the cast has cooled enough so that the color has drained from it, unwrap the cuttlebone over a metal pot filled with cool water and drop in the cast. Finish unwrapping the used cuttlebone and douse it in the water as well. Never allow your hand to be in the possible path of the falling metal, and work close to the surface of the water. Do not quench the charcoal block.

For pewter: Pewter will appear to "frost over" and have a matte finish when cooled. Test pewter by gently tapping the sprue with your stirring rod. Follow the unwrapping process as you would for silver or bronze, but allow your cuttlebone to cool on its own, as you will most likely be able to use it to cast again since pewter has a much lower melting temperature. It makes sense to keep silver and pewter tools and workspaces separate, as pewter can alloy with silver and cause it to melt at a much lower temperature, opening holes in the silver.

A note about using pewter in the classroom: Decide in advance if your studio and tools will be used for any metal other than pewter. It is introduced here for the school teacher as a great alternative to casting silver, but be aware that pewter will cause cross-contamination with silver and other metals.

CLEANING THE CAST

For silver or bronze, place it in a solution of pickle, like sodium bisulfate, once the piece is quenched to remove any oxidation. For bronze, you may need to add hydrogen peroxide to the pickle, or use hydrogen peroxide and white vinegar (a three-to-one ratio is good) as your pickling solution. Pewter does not need to be pickled, and should be ready to have the sprue removed.

SPRUES

The best way to remove sprues from a silver and bronze cast is to use a jeweler's saw. I recommend a #4 saw blade as an all-around blade for cutting off sprues. For removing sprues from a pewter cast, a good flush cutter works well. Flashing and any vents that may have been cast can also be removed with the flush cutters.

FILING AND SANDING

While filing removes marks creating by sawing off sprues and flashing and can shape the work, sanding removes file marks and small irregularities in the surface. Start with a coarse grit and work your way up to progressively finer and finer sandpaper grits.

POLISHING

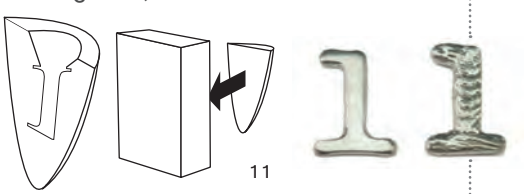
An excellent final polish can be achieved with very fine steel wool or a fine bristle brass brush. If your budget allows, a tumbler is a great idea for finishing the projects.

PATINAS

A good patina to use on sterling silver and bronze is liver of sulfur. For pewter, there are a few commercially available patinas like Novacan Black and Jax.

TWO- AND THREE-PART MOLDS

Once students gain experience, they can experiment with more complex casts using multipart molds. In a one-part cast, as in Figure 11, the back is flat.

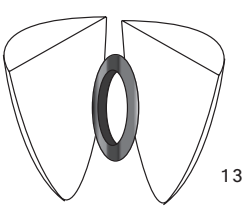


11

I wanted to pay homage to the long history of jewelry making, so I cast my wedding band using cuttlebone in a two-part mold. You can see the cuttlebone texture on the inside.

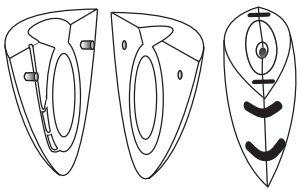
12

A model can be pressed between the two halves, or you can carve into the cuttlebone.



13

To maintain alignment, key-up the mold parts, or use a Sharpie on the outside. Look into the mold through the sprue before taping together to see if the molds are lined up.

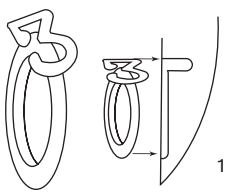


14

A three-part mold is necessary sometimes. In this case, the "three" on top of the ring in Figure 15 would be impossible without a third part to the mold.

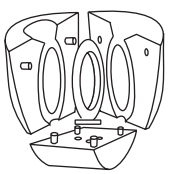
15

Three-part molds are necessary when an undercut area exists. As you can see in Figure 16, the detail in the top of the ring would not come out in a two-part mold.



16

Use a third cuttlebone piece and carve or press your design into it.



17

All image and photo credits: Jim Bové. / Jim Bové is a practicing artist, educator, and former SNAG board member. His artwork has been featured in several magazines and books, including Humor in Craft, 500 Art Necklaces, On Body and Soul: Contemporary Armor to Amulets, *and most recently in* Cast: Art and Objects. *His artwork has been exhibited nationally and internationally. / Jim Bové would like to thank Kaci Maden, Jenn Polando, and Taylor Stefanko for assisting with the photo shoot.*

Additional images showing how to prepare the cuttlebone and steps in the design, casting, and finishing processes can be found online at http://www.snagmetalsmith.org/metalsmith-magazine/metalsmith-extra.

Cuttlebone Cast Examples

Examples of student work.

This cast was turned into a ring. Notice the difference in texture. One is pressed in and cast; the other has the cuttlebone texture exaggerated with a brush.

Shawn Shannon created this Memento Mori of portraits made using the lost-wax casting process and cuttlebone cast accents.

Cuttlebone casting is an excellent way to create multiples. Artist Robert Clark Dean created these charms and chain links by first carving a shape out of wood and then pressing the form into the cuttlebone.

TECH TALK

E-etching Copper and Silver with Copper Nitrate

BY BEN DORY

FOR MOST PEOPLE, the term *electrolysis* only appears in science textbooks and classrooms, although we also encounter the term *electrolytes* in advertisements for energy and recovery drinks. What does electrolysis have to offer metalsmiths? Through a process called e-etching, we can use electrolysis to etch copper and its alloys, as well as sterling silver.

This update of my 2015 SNAGtech article is an introductory guide for bringing e-etching into the classroom and studio. It also includes some new possibilities for using e-etching techniques, demonstrated through the work of artists Marissa Saneholtz and Bryan Parnham. Their daily practices exemplify two particular instances in which this process thrives, respectively: etching for champlevé enamel and silver etching.

Copper nitrate in solution is a particularly unique and effective option for metalsmiths. This piece is intended to be a useful general resource to create more process alternatives for metalsmithing studios. Our position on studio and environmental safety is reflected through how we approach chemical-heavy processes like etching. E-etching with copper nitrate is more efficient, safer, and cleaner than traditional methods.

E-ETCHING: THE PROS AND CONS

My aim has been to create a home studio in which there is no place for caustic acids or salts. Likewise, while teaching, cleanliness, safety, cost, and volume are always considerations. Etching with copper nitrate creates a way to eliminate acid, with the added bonus of etching both copper and sterling. This discovery comes from much experimentation with other solutions. Ferric chloride and ferric nitrate are slow, taking patience and babysitting to reach the desired etching depth. Nitric was always out of the question; the benefits and even the limits of other methods far outweigh the precautions and safety measures needed to use and dispose of this acid responsibly. E-etching with copper sulfate is slow, and an acceptable depth is hard to reach. E-etching with salt water, while successful when moving between copper and steel, creates erratic results, and bath chemistry changes quickly, as chlorine ions combine into new compounds. For all e-etching, the surface can appear microcrystalline with the best results, like fine sandblasting. Edges do not undercut, as with acid. Rather, they fillet slightly where the horizontal and vertical walls join.

Alfonso Crujera
Gpplh 13, 2003
Zinc printing plate created using e-etching
19 3/4 × 19 3/4"
Photo: Luvier Casali

FINDING A SOLUTION THROUGH PRINTS

The cross-disciplinary nature of etching means that metalsmiths can draw from a wide variety of sources, especially printmaking, for inspiration in aesthetics, technique, and studio practice. Inquiries by printmakers over the past decades have led to the rediscovery of e-etching in the studio environment. Comprehensive guides written by these printmakers, both in print and online, are an invaluable resource for e-etching. When I began to think seriously about e-etching after working with Arthur Hash at the Penland School of Crafts, I found further inspiration from Alfonso Crujera, a printmaker in the Canary Islands. He champions copper sulfate for e-etching to prepare plates for intaglio, aquatint, and numerous other processes, as exemplified in his *Electro-Etching Handbook*. This book was my first exposure to a process that did not off-gas or need to be refreshed.

Bryan Parnham
New Structure Necklace, 2016
silver and industrial primer
12 × 6"
Photo: Bryan Parnham

HELPFUL TERMS:

Electrolyte: A solution that contains ions, which can be either positively or negatively charged particles.

Electrolysis: A chemical reaction caused by passing an electric current through an electrolyte. This usually causes decomposition—or in other terms, etching.

Electrolytic (E)-etching: Forcing an electric current from a DC power source to metal plates in a charged solution to selectively remove surface material.

COPPER NITRATE IS:

Efficient: Only one bath needs to be made. Solutions can be taken from a larger bath as needed and returned when etching is complete.

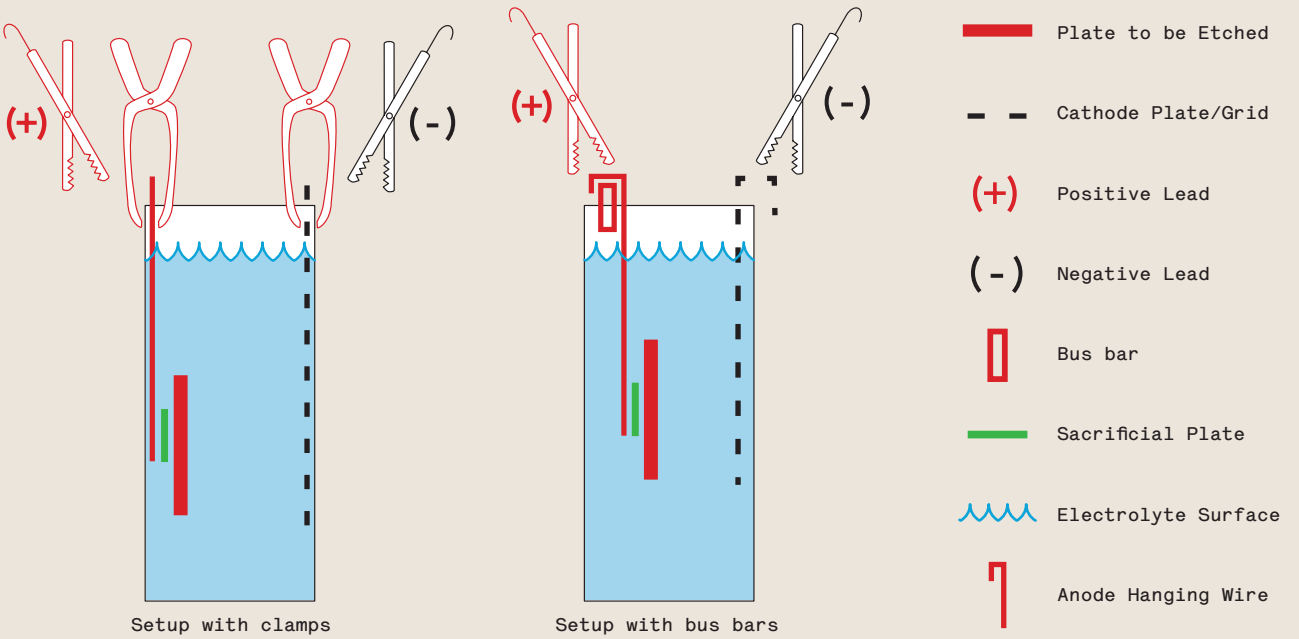
Self-perpetuating: The end result of etching is more copper nitrate. Newly available copper ions bond with the nitrate to start the reaction anew.

Consistent: The amperage raises to a steady current, which results in an even etch. Likewise, the results are replicable with the same bath over time.

Safe: There is no off-gassing; disposal is only necessary when the bath is not useful anymore, and the solution may be safely stored.

Easy: The only upkeep is to maintain the water level if it evaporates.

Setting Up Your E-Etching Bath



E-etching with copper sulfate has replaced traditional techniques in many studios around the world in which health and safety are a priority. Printmakers' techniques in setup and preparation, even though they aim for different results, are invaluable resources. But again, the end goals of etching for metalsmiths is often very different that those of printmakers. R.L Jackson's article "Relief Electro-Etching for Champlevé Enameling" published by the Guild of Enamellers (http://www.guildofenamellers.org) led me to copper nitrate, which has become my sole etching solution for copper and silver.

BUYING COPPER NITRATE

When looking to purchase copper nitrate for your studio, consider The Science Company (www.sciencecompany.com) as a reliable source. Cupric nitrate is sold from 100g to 2.5kg. Cheaper—but non-credentialed—options are available on eBay. The specific chemical that they sell is cupric nitrate trihydrate.

MIXING SOLUTIONS

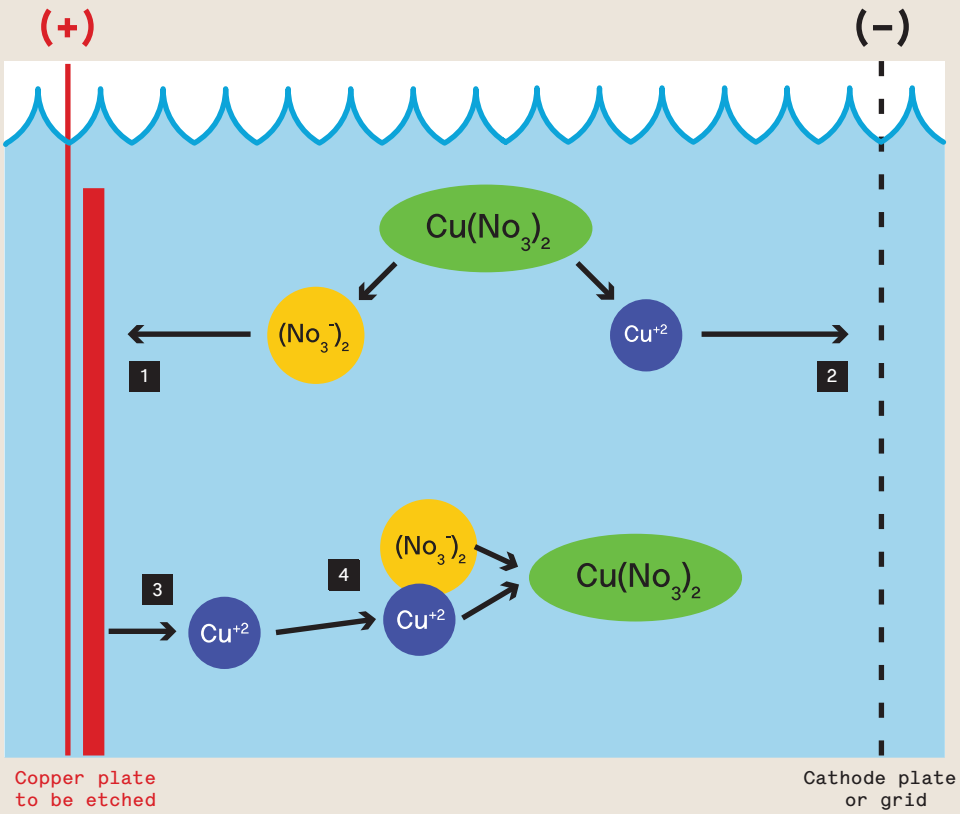
Wear gloves, eye protection, and a mask when working with the copper nitrate crystals. This is a precaution; the crystals are not a fine dust and do not release caustic fumes. Since 1 ml of distilled water equals 1 g, mixing solutions by mass can be quite simple. A 25% solution of copper nitrate in water provides great etching results. To mix this, begin by zeroing a metric scale with your chosen container on top. Add water until the mass matches the volume that you want, and set to the side. In a separate container, measure out the copper nitrate to a mass that is 1/4 of the water mass, then add copper nitrate to the water. Always add your chemicals to water—not vice versa, to avoid a potential undesirable reaction—and stir until the crystals have dissolved.

MATERIALS AND SUPPLIES

- DC power source: This can be a plating rectifier (3A will be plenty for the vast majority of projects). A DC wall plug with wires stripped at the end is cheap and useful if you are etching small pieces (the amperage rating is not high enough for larger pieces).
- Copper nitrate: This only needs to be purchased once, and 500g should run about $30.
- Positive and negative leads with alligator clips: Traditionally the positive lead is red, and the negative, black.
- Plastic or glass container large enough to submerge your piece, with room for a cathode sheet.
- Cathode: These should be copper, silver, or stainless steel sheet or mesh, and approximately half to the same size as the surface area to be etched. You should match copper to copper and silver to silver, but stainless works for both.
- Extra metal: This is to connect the leads to your plates. Think of these as consumables, as they may etch along with your work.
- Copper or silver anode: This is the plate you will etch.
- Materials or tools for suspending your plates, like clamps or bus bars.
- Distilled water
- Etching resists: Vinyl, BioLac, Lascaux acrylic resist, tape, spray paint, paint pen, waxes, oil-based crayons, and other materials will all work well.
- Steel wool or steel scraps in water for converting copper ions.
- Washing soda/soda ash or baking soda for neutralizing
- An N95 particulate mask (at least)
- Nitrile/latex/rubber gloves

Your bath does not need to be complicated. Make sure your container has vertical walls. For an even, consistent etch, it is essential that your plates are parallel to each other. Sometimes you will have to back your plates to get them to hang vertically in curved containers or from bus bars. The best results come when the plates are two to four inches apart. Double-check your leads to ensure that the plate you want to etch (anode) is attached

The Chemistry



The process begins with copper nitrate $Cu(No_3)_2$ in solution with H_2O

When a current runs through each lead:

The charge at each electrode separates the $Cu(No_3)_2$ into oppositely charged ions

1. $(No_3^-)_2$ is attracted to the negatively charged cathode grid, plating the surface
2. Cu^{+2} is attracted to the positively charged exposed areas of the copper plate
3. $(No_3^-)_2$ oxidizes the exposed copper, releasing Cu^{+2} from the plate and into the solution
4. Cu^{+2} bonds with the free $(No_3^-)_2$ creating new $Cu(No_3)_2$

The process repeats as long as a current is present.

to the positive line. Use a sacrificial plate to connect the anode wire to your work to help prevent etching the back of the plate.

ETCHING

A few easy habits will help ensure etching success. Turn the power on or off before you handle the plates. Slow down and lower the voltage to improve the quality of the etch. Corners will stay sharper and etched surfaces will be more refined. If the voltage is too high, you will start to see bubbles at the surface of your solution. This is *hydrolysis,* or the separation of water molecules. You want the electricity to focus on your copper nitrate solution. Record the volume of solution, percent solution, voltage, resist and distance of your plates. Your results are replicable—good and bad!

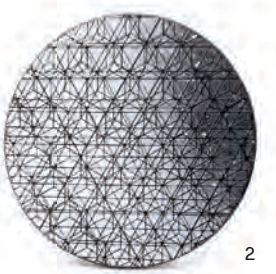
FROM THE FIELD

Marissa Saneholtz implements e-etching with copper nitrate for both her personal work in champlevé enamel and while teaching at Bowling Green State University. Traditionally, you need to etch halfway through the copper for the enamels to hold, and Saneholtz does this to great success. Familiar masking techniques such as nail polish and PnP work well with this process. Saneholtz has used a 25% solution steadily for two years, with her rectifier between 4 and 4.5 volts.

Bryan Parnham has implemented copper nitrate for etching sterling silver. He utilizes PnP and Puretch to create refined geometric patterns in metal surfaces. Additionally, Parnham experiments with photo transfer processes. When etching silver, metal solids will accumulate in your bath. These will settle to the bottom and not interfere with further etching. Conversely, they can be removed and stored. Parnham refines the silver solids with Hauser & Miller, which will take your scraps and sweeps and refine them for a check, credit, or traded for new metal with a discount (http://www.hauserandmiller.com/refine/). In his process, 3x6-inch sterling plates are etched for roughly forty-five minutes, adjusted for more or less exposed metal. Parnham sets his rectifier to 3 volts in a 25% solution. His bath has been used continuously for more than two years.

Ben Dory is a studio jeweler in Savannah, Georgia and the lead technician in the rapid prototyping lab at the Savannah College of Art and Design.

1



2

5

3

4

1
Bryan Parnham
Daniel Tryptich, 2016
copper, silver,
industrial primer, photo
2 1/2 × 2 1/2" (each panel)
Photo: Mercedes Jelinek

2
Bryan Parnham
New Structure Brooch, 2017
silver and industrial primer
3 × 3"
Photo: Bryan Parnham

3
Marissa Saneholz
The traditions were hers to change, 2017
copper, enamel, decal,
sterling silver, pearls,
silk, stainless steel
3 × 1 1/2 × 3/8"
Photo: Sara Brown

4
Marissa Saneholz
She could only ignore it for so long, 2015
copper, enamel, found
object, sterling silver,
stainless steel
2 1/4 × 2 1/2 × 1/4"
Photo: Sara Brown

5
Marissa Saneholz
The hits just keep coming, 2016
copper, enamel, pearls,
sterling silver,
stainless steel
2 × 3 1/3 × 1/4"
Photo: Sara Brown

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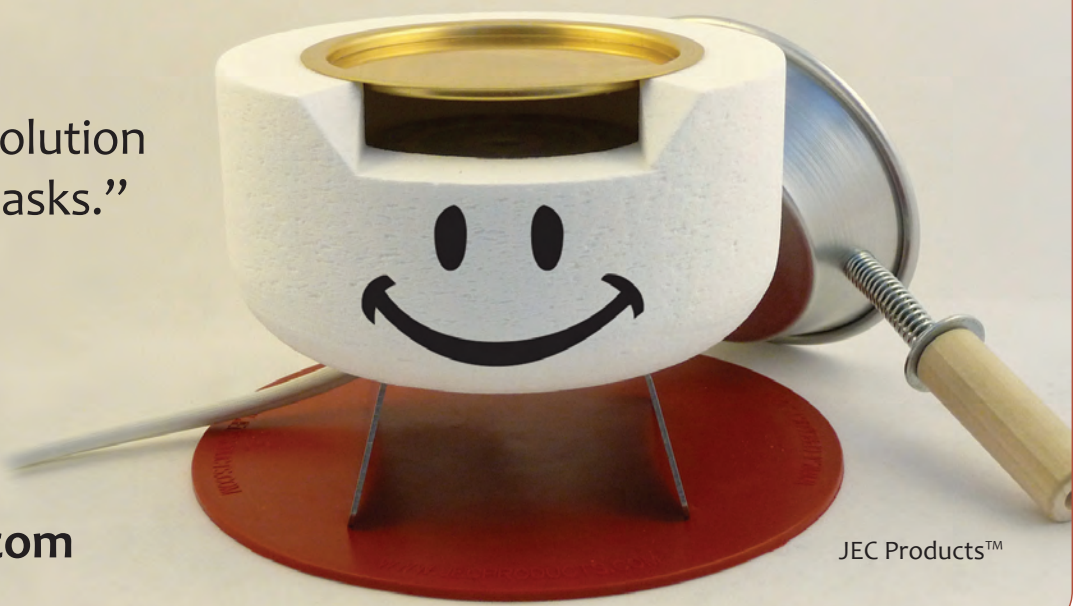
Pat Evans
Creator Haven Studio



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